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(54) Improvements to an emergency shelter.

(57) An emergency shelter (1) for use in an ambient polluted by gas, noxious substances dispersed in the atmosphere and the like.

The shelter comprises a base (2) and a deformable envelope (3) of impermeable elastomeric material forming a closed space for lodging a plurality of persons.

The envelope walls comprise at least two superimposed sheets (6, 7) forming a closed air-space (8) inflatable with a fluid under pressure and means (20, 21) for regulating the overpressure of the fluid with respect to the outer ambient.

Inside the shelter there are masks for the individual breathing with the relative valves associated to the walls.

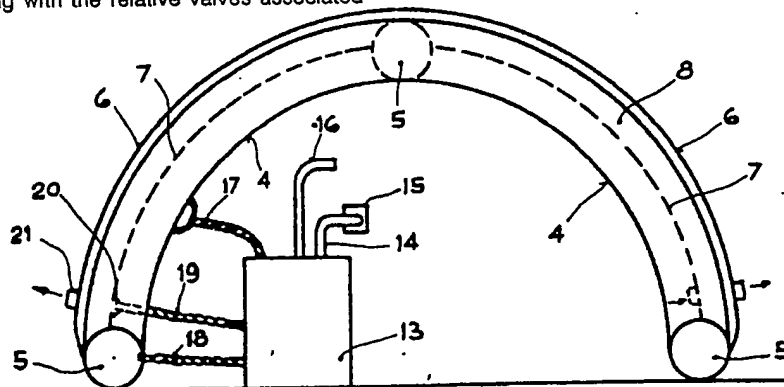


Fig. 2

EP 0 345 600 A1

IMPROVEMENTS TO AN EMERGENCY SHELTER

The present invention is directed to some improvements to an emergency shelter and more particularly to some improvements to the emergency shelters comprising an inflatable envelope for lodging and safeguarding a plurality of persons in an ambient polluted by gas or noxious substances dispersed in the atmosphere or the like.

Devices apt to constitute an emergency shelter are already known, as for example that described in the Italian patent No. 1,161,847 of the same Applicant.

The known device comprises a base and an impermeable envelope variously folded upon itself in rest condition and then spread out upward by an inflatable element to delimit an air-tight room inside of which a plurality of persons can be lodged.

The device avails itself of suitable means to permit the breathing, for example breathing masks distributed inside the shelter associated by two corrugated hoses to the inhalation and exhalation valves applied on their turn to the envelope walls.

The device comprises also special means to establish an overpressure inside the shelter, for instance a pedal bellows or a fan or a compressed air bottle connected by the ducts to the inhalation filters associated to the envelope walls.

This device is intended to constitute an emergency shelter, easily transportable with a helicopter into a polluted zone, where after having been let down with a rope is automatically inflated and becomes a temporary shelter for safeguarding a plurality of persons.

The known emergency shelter is satisfactory, of simple and prompt utilization and generally suitable for civil and/or military uses.

However, there are particular ambient circumstances where the high concentrations of noxious substances or of particular gases, as yperite or other war gases, require a still more advanced protection than that available up to now.

In fact in the cited circumstances a permeability of the flexible layer forming the envelope could occur unavoidably little by little in the time with evident unacceptable drawbacks for the users of the shelter.

Therefore the present invention aims at providing an emergency shelter devoid of the previously cited drawback which is contemporaneously of simple manoeuvrability and rapid use.

The object of the present invention is an emergency shelter for use in an ambient polluted by gas, noxious substances dispersed in the atmosphere and the like, said shelter comprising a base and a deformable envelope of impermeable plastic or elastomeric material forming the walls of the

shelter, at least one opening on the shelter walls and means for closing in a tight manner said opening, said envelope being inflatable from a first configuration according to which it results to be folded upon itself to a second configuration corresponding to a space closed among the base and the walls for lodging a plurality of persons, said shelter being characterized by the fact that the envelope comprises superimposed sheets sealed to one another along two pairs of sides, the sides of the two pairs being substantially transversal to one another, said superimposed sheets originating a closed air space inflatable with a fluid under pressure, means being provided for feeding fluid at the air space between the superimposed sheets and means for regulating the overpressure of the fluid in said air space with respect to the ambient outside the shelter.

According to a preferred embodiment, the shelter is characterized by the fact that the ends of the superimposed sheets of the envelope are associated to supporting elements formed by inflatable tubular elements of impermeable material.

According to the cited embodiment the shelter supporting structure can be formed by any whatsoever number of inflatable tubular elements and assume shapes and dimensions as desired, for example the shelter could have a half-circle cross section with supporting elements extending circumferentially between the opposite sides of the base or a polygonal section with supporting elements formed by a plurality of consecutive rectilinear portions extending between the opposite sides of the base or a rectangular section with the supporting elements perpendicular to one another forming the lateral walls and the roof or in general other shapes, such as a pyramid; conic or truncated-cone shape.

The present invention will be better understood by the following detailed description made by way of non-limiting example with reference to the figures of the attached sheet of drawing in which:

FIGURE 1 - is a diagrammatic perspective view of an emergency shelter;

FIGURE 2 - is a front view of the shelter supporting structure of figure 1 and the air space between the superimposed sheets forming the walls of the shelter;

FIGURE 3 - is a cross section of the air space between the superimposed sheets sealed to adjacent supporting elements of the supporting structure;

FIGURE 4 - is a partial top view of the supporting structure of figure 1.

In figure 1 reference numeral 1 represents an emergency shelter for use in ambients polluted by gases, such as yperite or poison and pollutant gases, substances injurious to breathing or aggressive to skin dispersed in the atmosphere or gas exhalations caused by fires and working irregularities in a production cycle near a factory.

The emergency shelter 1 is apt to lodge a plurality of persons protecting their safety from the pollutant effects of the outer ambient.

The shelter 1 comprises a base 2 and an envelope 3 sealed at the base.

The envelope is of impermeable plastic or elastomeric material to be inflated from a first configuration where it results to be folded upon itself to a further configuration corresponding to a space closed between the base and the wall for lodging a plurality of persons.

According to the preferred embodiment the envelope 3 is made of rubberized fabric, in particular a fabric comprising synthetic fibers of nylon or polyester or aramidic fibers associated to synthetic elastomers, in general rubber materials impermeable to particular gases depending on the ambient conditions that it is wished to face.

The base 2 according to some embodiments, could be formed by a rigid layer made impermeable by means of a suitable covering or, according to other solutions, the base could be formed by inflatable elements, as for instance a pneumatic bottom.

The envelope 3 comprises a suitable opening (not shown) and means of closing in a tight manner the opening, both explained hereinafter.

The envelope 3 comprises a supporting structure formed by a first plurality of inflatable tubular supporting elements or pillars 4 distanced from one another and extended circumferentially and by a second plurality of inflatable tubular supporting elements 5 disposed both in central position and at the sides of the envelope on the base 2.

The tubular elements have the double function of forming the supporting structure and spreading out the envelope 3 according to its final shape when a fluid under pressure is supplied inside them.

As diagrammatically shown in figure 2, the inflatable tubular supporting elements 4 protrude from the lateral ones 5 on the base and converge on the supporting elements 5 arranged in central position.

The various supporting elements forming the supporting structure have independent chambers and are then connected to one another at the relative crossing zones through jointing means or adhesives of known type, as the dashed line of figure 4 shows.

The essential characteristic of the present in-

vention consists of arranging at least two sheets of rubberized fabric 6 and 7 superimposed one upon another (figure 3) and sealed at the ends between pairs of opposite sides.

The first pair of sides is constituted by adjacent tubular elements 4 and the second pair is constituted by tubular elements 5, central and lower on the base 2, respectively.

The two sheets 6 and 7 are joined in such a way as to originate an air space or bag 8, delimited by substantially transversal sealing lines; the air space is inflatable by supplying its inside with a suitable fluid under pressure, for instance air.

In practice, with reference to the figures 1 and 4, the areas 9, 10, 11, 12 delimited by tubular elements perpendicular to one another are formed by superimposing two sheets which give rise to a number of air spaces equal to the cited areas or a single air space if the outer sheet is sealed only at the ends reducing the four areas to only one area.

Further, the envelope comprises front parts 13 and 14, each of which can be formed by at least two superimposed sheets originating an air space filled with a fluid under pressure likewise what already described and shown in figure 3.

The two parts 13 and 14 can be approached or moved away through a zip-fastener or by making recourse to the adhesive operation of the lips with known systems.

According to this solution any possible closing imperfection of the zip-fastener or of the lips already treated with the adhesive operation can be compensated with the overpressure realizable inside the shelter.

The emergency shelter 1 comprises means for feeding fluid under pressure, for instance air, either at the tubular elements 4 and 5 and the envelope 3 and also at the various air spaces 8 between the superimposed sheets 6 and 7.

Moreover, means are provided to regulate the pressure of the fluid in the air spaces 8 with respect to the ambient outside the shelter.

The means for feeding the fluid are realized through a compressor 13' arranged on the base 2 and a generating set (not shown) arranged outside the shelter and connected to the compressor through a suitable circuit.

In alternative to what cited, the compressor could be placed outside the shelter.

The compressor 13' is connected by means of a hose 14' to a suitable filter 15 associated to the envelope walls to inhale air from the outer ambient.

Moreover the compressor 13' through the hoses 16 sends air already filtered to the envelope inside and through the hoses 17, 18, 19 sends air both to the inflatable tubular elements 4 and 5 and to the air space 8.

Of course, the hoses for the tubular elements

and the air spaces are in a number corresponding to the various independent chambers to be inflated.

The means for regulating the air overpressure in the various air spaces 8 are constituted by valves 20 and 21, inlet valve and air valve, of known type, suitably calibrated to permit the air to escape outwards or to get into the air space so as to have always an overpressure with respect to the outer ambient, preferably of 0.01 atm.

Inside the shelter, there are different means for the individual breathing, namely breathing masks provided with inhalation and exhalation hoses; the ends of said hoses are associated either to an inhalation valve unit and relative filter or to the exhalation valve. The valves of the masks are applied to the walls of the envelope.

The large number of means to safeguard the plurality of persons can be of the type described in the Italian patent No. 1,161,847 of the same Applicant.

Moreover, the envelope inside can be provided with a plurality of zones independent of one another used for the decontamination of suits used by the staff for various interventions outside the shelter.

The invention achieves the aimed purposes.

In fact, the principle of the invention is based on the contemporaneous presence of a plurality of barriers of different type, each one opposing any possible penetration of gas or other pollutant substances from outside to inside of the envelope.

A first barrier of mechanical type is constituted by the outermost sheet.

A second barrier, this of pneumatic type, is formed by an air breath under overpressure towards the outer ambient.

This pneumatic barrier is determined by the two sheets 6, 7 filled with a fluid maintained by the calibration of the inlet and air valves at an air pressure sufficient to push back the gases and the pollutant substances at room pressure.

A third barrier is of fluid-mechanics type and is originated by the fact that the volumes involved in the air spaces between the superimposed sheets are small, so that through small inlet and air valves in each air space it is possible to make a frequent change of air. In practice there is a continuous air washing inside the air spaces, with the advantage of expelling constantly possible small pollutant traces which have overcome the first and second barriers.

In particular the realization of the air spaces in which the two sheets have the maximum distance from each other comprised between 3 and 10 cm is advantageous.

A four barrier, of mechanical type is then represented by the innermost sheet of each air space.

Moreover the invention permits to have a considerable increasing of the resistance of the envelope walls so that they can support the possible accessories present inside the shelter, as for example high capacity filters for a fan, valves for different breathing masks, suction hoses, electric parts for the connection with the outer generating set.

The cited optimal result is due to the fact that the overpressure inside each air space 8 places under tension the various fabrics originating in practice a kind of stiffening useful to the just cited purposes.

Further it is evident how the stated solution has in combination with a high impermeableness to gases, the further characteristic of a prompt and easy use which derives from the presence of parts of impermeable elastomeric material suitable for an immediate inflation operation, in case also through bottles of fluid under pressure.

Although some embodiments of the present invention have been illustrated and described, it is understood that the present invention includes in its scope any other alternative embodiment accessible to a technician of the field.

Claims

1. Emergency shelter (1) for use in an ambient polluted by gases, noxious substances dispersed in the atmosphere and the like, said shelter comprising a base (2) and a deformable envelope (3) of impermeable plastic or elastomeric material forming the walls of the shelter, at least one opening on the walls of the shelter and means for closing in a tight manner said opening, said envelope being inflatable from a first configuration according to which it results to be folded upon itself to a second configuration corresponding to a space closed among the base and the walls for lodging a plurality of persons, said shelter being characterized by the fact that the envelope comprises superimposed sheets (6, 7) sealed to each other along two pairs of sides (4, 5), the sides of the two pairs being substantially transversal to one another, said superimposed sheets originating a closed air space (8) inflatable with a fluid under pressure, means (13) being provided for feeding fluid at the air space between the superimposed sheets and means (20, 21) being provided for regulating the overpressure of the fluid in said air space with respect to the ambient outside the shelter.

2. Emergency shelter as in claim 1, characterized by the fact that the ends of the superimposed sheets of the envelope are associated to supporting elements (5) formed by inflatable tubular elements of impermeable material.

3. Emergency shelter as in claim 1 or 2, characterized by the fact that the overpressure of the fluid inside the air space between the superimposed sheets is at least 0.01 atm with respect to the outer ambient.

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4. Emergency shelter as in claim 1 or 2 or 3, characterized by the fact that the distance between the superimposed sheets inside the air space in the presence of the fluid under pressure measured at the maximum separating relative point is comprised between 3 and 10 cm.

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5. Emergency shelter as in any one of the preceding claims, characterized by the fact that the envelope is made of a rubberized fabric.

6. Emergency shelter as in claim 1, characterized by the fact that the feeding means comprise a compressor (13') provided with a filter (15) to depurate the air outside the shelter before its introduction into said air space between the superimposed sheets.

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7. Emergency shelter as in claim 6, characterized by the fact that said compressor provided with a filter is disposed inside and on the base of the shelter.

8. Emergency shelter as in claim 1, characterized by the fact of comprising a base (2) covered with a layer of rubberized fabric and an envelope (3) formed by a plurality of inflatable tubular elements (4) of rubberized fabric, said elements being distanced from one another and extending between opposite sides of the base, the adjacent tubular elements being connected by two superimposed sheets (6, 7), the ends of the superimposed sheets being sealed on the tubular elements.

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9. Emergency shelter as in claim 8, characterized by the fact that said inflatable tubular elements (4) protrude from the opposite sides of the base and extend up to a central inflatable tubular element (5) disposed at the maximum height with respect to the basic surface.

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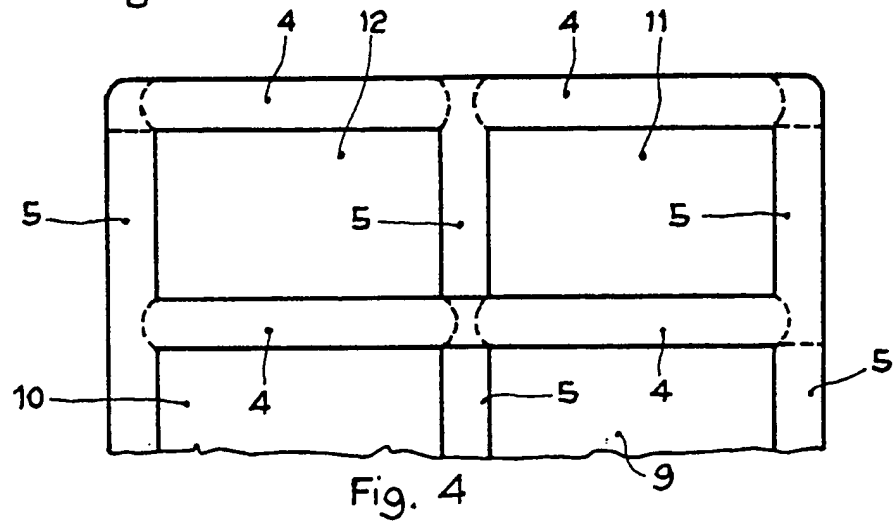
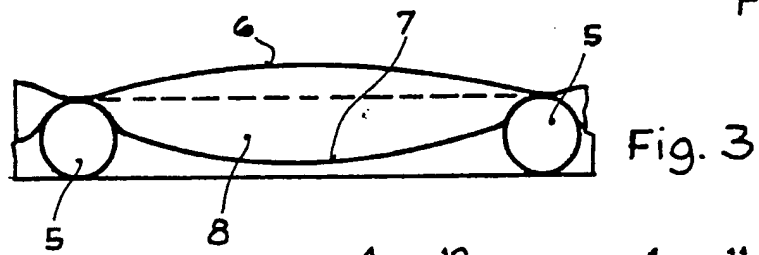
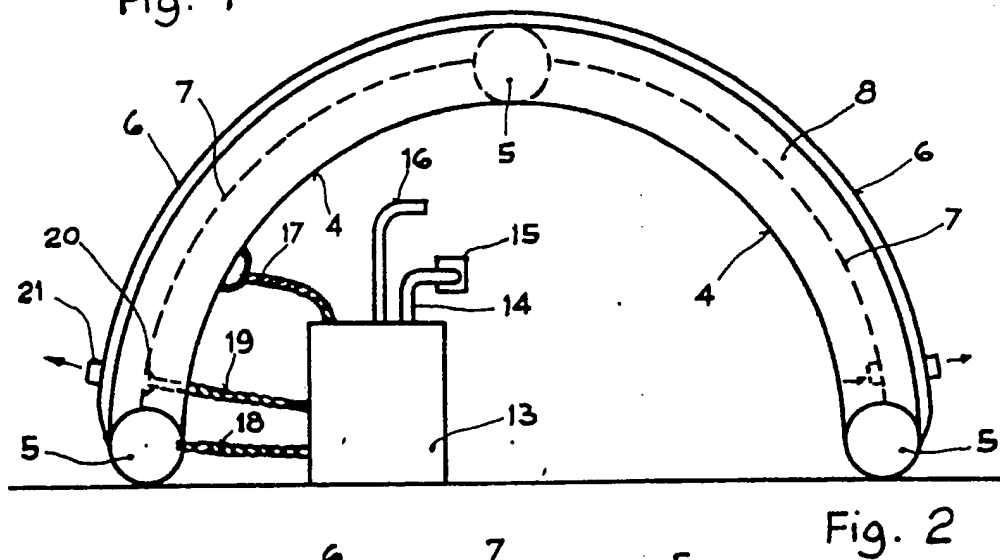
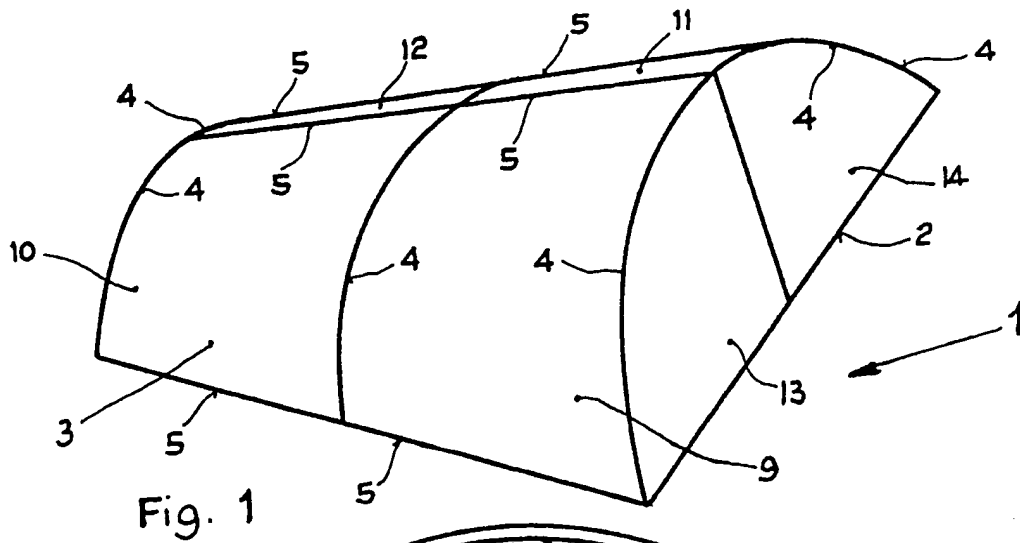
10. Emergency shelter as in claim 1, characterized by the fact of comprising a semi-circle shape in cross section.

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EUROPEAN SEARCH REPORT

Application Number

EP 89 10 9700

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
Y	US-A-4 114 325 (HOCHSTEIN) * Column 1, line 18 - column 2, line 14; column 2, lines 18-33; column 2, line 46 - column 3, line 5; figures *	1-2,6,7,8	E 04 H 15/20 E 04 H 1/12
A	---	4	
Y	EP-A-0 075 483 (AIRBORNE INDUSTRIES) * Page 1, lines 3-5; page 1, line 27 - page 2, line 5; page 4, lines 28-35; page 5, line 32 - page 6, line 19; figures *	1-2,6,7,8	
A	---	3	
A	DE-U-8 627 545 (KÄRCHER) * Page 4, line 3 - page 6, line 23; page 7, line 6; figures *	1,2,9,10	
A	DE-A-2 634 873 (NOTTER) * Page 3, line 1 - page 4, line 33; figures *	1,2	
A	US-A-4 736 762 (WAYMAN) * Column 1, lines 5-7,10-12,50-58; column 1, line 65 - column 2, line 3; column 2, line 28 - column 4, line 28; figures * -----	1,2,3,9	TECHNICAL FIELDS SEARCHED (Int. Cl.4) E 04 H
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 11-09-1989	Examiner LAUE F.M.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	